The Epidemiology of Heat-Related Deaths, Texas—1950, 1970–79, and 1980

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Abstract: A study of the deaths during a 1980 heat wave in Texas revealed death rates that were highest in males, the elderly, Blacks and those engaged in heavy labor, the latter two factors perhaps reflecting socioeconomic status. The data suggest that persistent high temperatures were related to death to a greater degree than the temperature peaks reached. Higher heat death rates in earlier years are believed to be attributable to the limited availability of air conditioning in those years. (*Am J Public Health* 1983; 73:805–807.)

Introduction

Afternoon temperatures in much of northwestern Texas were in excess of 100°F for 61 of the 71 days between June 18th and August 27th, 1980. There were 31 consecutive days when the daily high temperature ranged from 101°F to 112°F in Dallas County. The average daily high temperature during this period was 104.5°F. High temperatures up to 102°F continued to occur intermittently until September 22nd.

From May through September 1980, there were 107 deaths reported as due to heat, the largest number of such deaths reported since 1951. The literature on the effects of excessive heat on mortality rates has suggested that excess mortality is the best retrospective indicator of the effect of hot weather because of underreporting of heat deaths;[1–5] there is a lag period of one to three days between maximum temperature and maximum mortality and consecutive days of high temperature have a greater effect on mortality than variable temperatures.[1,3,5–7] The experience of the 1980 heat wave in Texas is consistent with these observations and suggests that preventive measures must be undertaken very early in a heat wave to be effective.

Methods

The term "heat-related death" was selected because of the variation in terminology found on death certificates.* Only those certificates coded as heat-caused deaths occurring during May through September are included.**

All data analyzed were taken from the death certificate. In 1980, a block for designating "Spanish Origin" first appeared; prior to 1980, this category was assigned on the basis of a Hispanic surname. Laborers, construction workers, farmers and others whose listed occupation usually involves continuous physical exertion were considered to be engaged in heavy labor. Everyone over 70 years of age was considered to have been retired.

Temperature data for Dallas County were obtained from the Texas Natural Resources Information Service; population estimates based on national census reports for 1950, 1960, 1970, and 1980 were provided by the Bureau of State Health Planning and Resource Development, Texas Department of Health.

Results

Figure 1 shows the heat-related death rates reported in Texas from 1950 through 1980. During this period, there were 919 such deaths, 453 (49.3 per cent) of which occurred from 1950 through 1959. Six years (1951, 1952, 1954, 1962, 1978, and 1980) accounted for 468 or 50.9 per cent of the deaths.

The greatest number of deaths during the 1980 heat wave occurred in late June and early July, although hot weather persisted into September (Figure 2). Forty deaths occurred during the week of June 26. Only six occurred in August and one in September despite increased physician alertness for this cause of death.

Age specific mortality of heat-related deaths in 1980 increased from 1.9 among those under age 40 to 58.7 per million among those over 70 years of age; mortality in males equaled or exceeded that of females in all age groups. The age-adjusted rate for Blacks, 21.1 per million, was higher than the 8.1 per million rate in Whites (including Hispanics).[6]

An occupation involving heavy labor predominated among males with heat-related death (Table 1). However, among Black males there was also a predominance of heavy

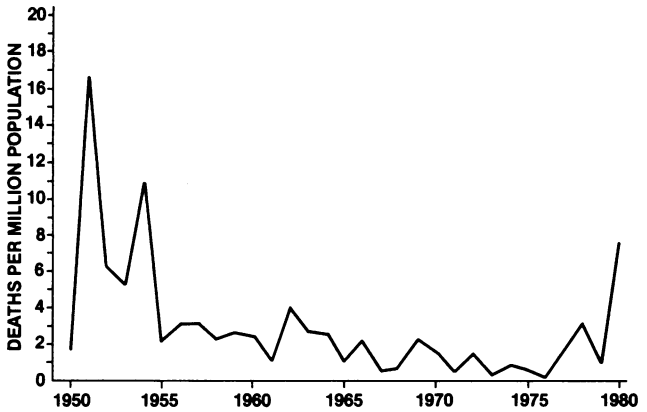

FIGURE 1—Number of Deaths per Million Attributed to Heat, Texas, 1950–1980

*All death certificated counted contained a reference to heat in some form in the first line of the death certificate.

**Nineteen of 390 total reported heat deaths occurring during the years 1951, 1970–1979, and 1980 were excluded. The excluded deaths occurred at times of the year and under circumstances inconsistent with death due to elevated environmental temperatures.

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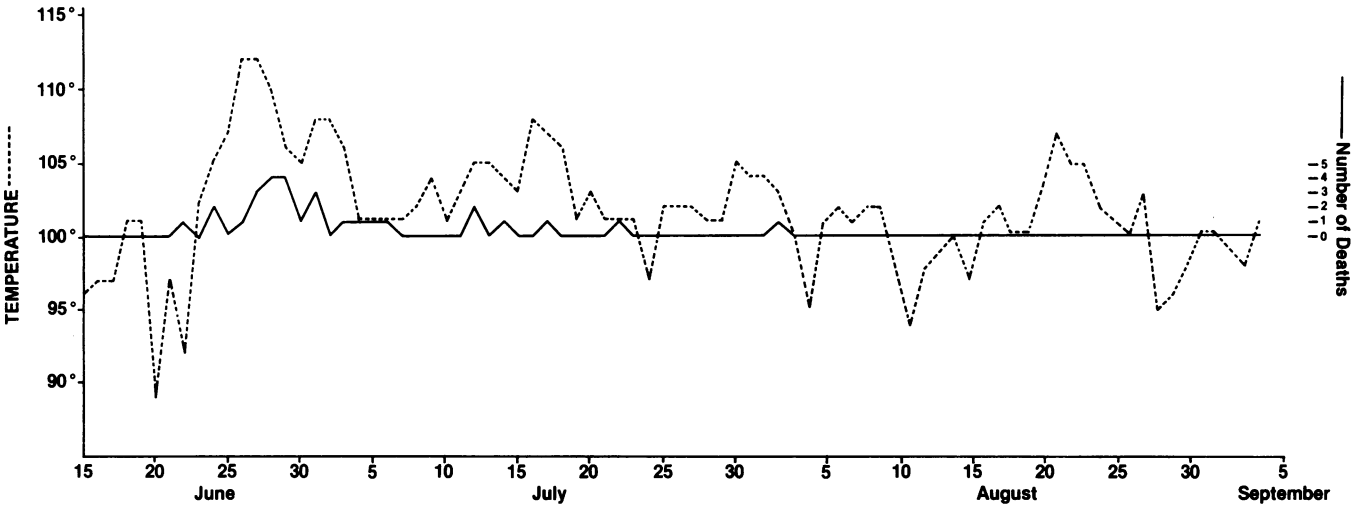

FIGURE 2—Maximum Temperatures and Numbers of Heat-Related Deaths by Day, Dallas-Fort Worth Metroplex, June 15–September 4, 1980

TABLE 1—Racial and Occupational Distribution of Heat-Related Deaths in Males, Texas, May through September 1980

	White		Black		
	Heavy* Labor	All Other Occupations	Heavy* Labor	All Other Occupations	Total Deaths
Heat-related Deaths	32	15	19	5	71
Deaths from Other Causes**	17	29	17	7	70

*Occupations involving continuous physical exertion such as construction work and farming.
**Matched for heat-related deaths for age, sex, race, region, and month of death.

TABLE 2—Number of Heat-Related Deaths, Annual Maximum Temperatures, and Number of Days in which the Maximum Temperature was >100°F and the Minimum was >80°F, Dallas County, May through September, 1951 and 1970–1980

	1951	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Deaths	28	0	0	1	1	2	1	1	2	17	0	19
Maximum Temperature (°F)	107	103	104	104	104	108	102	103	109	110	103	112
Number of Days with Afternoon High Temperature >100°F	34	19	16	11	1	14	5	6	43	39	3	70
Number of Days with Maximum Temperature >100°F and Minimum Temperature >80°F	20	13	12	4	0	9	0	0	8	19	2	26

labor in a comparison group of non-heat-related deaths in 1980,*** making it difficult to establish the relative effects of occupation and socioeconomic status.

Thirty deaths, 28 per cent of the total for the state in 1980, occurred in Dallas and Tarrant Counties where temperatures were generally the highest in the state. All but two of those deaths occurred during the period June 23rd through July 22nd when the maximum temperature reached 101°F or higher every day. Eleven of the 28 deaths during the period occurred during the three days June 27–29 immediately following the peak temperatures of 112°F on June 26th and 27th.

In Dallas, temperatures rose to highs of 107°F in 1951 and 112°F in 1980, the two years with the highest heat-related mortality (Table 2). The number of days when afternoon high temperatures were over 100°F correlated less well with excess heat deaths (r = .653) than the number of days when the high temperature was over 100°F and the low was above 80°F (r = .799).

Discussion

Heat-related mortality rates appear to be associated with peak afternoon temperatures, duration of excessive

***The comparison group was matched for age, sex, race, region, and month of death.

heat each day, and number of consecutive days of excessive heat. The first heat wave of a summer appears to produce the majority of heat-related deaths, suggesting that physiologic and behavioral adaptations are important (Figure 2). The 1980 heat wave was early in the season, perhaps catching people unadapted or unprepared.[2]

Populations at particular risk are those of low socioeconomic status, those engaged in heavy physical labor, and the aged. Low socioeconomic status probably limits the availability of air conditioning. The aged are more likely to have one or more chronic diseases which compromise their ability to make the physiologic adaptations necessary to tolerate prolonged periods of excessive heat.[3,5,8,9]

In spite of the fact that there were higher temperatures and more prolonged periods of heat in 1980, the mortality rate in 1980 was less than one-third that of 1951 in Dallas County. We ascribe the lower incidence of heat-related death in recent years to the wider availability of air conditioning.[7] The differences in incidence of heat death by race may also reflect the access to air-conditioned facilities as a function of economic status. Other socioeconomic factors such as overcrowding, poor housing conditions, and jobs involving outside heavy labor probably play a part as well.

Access to air-conditioned facilities is essential in preventing heat deaths, particularly in the elderly. With high energy costs, many of the elderly, as well as the economically underprivileged, will be at risk of heat death whenever there is a severe heat wave. Prevention of heat-related deaths also requires early recognition that a heat wave is in progress. In Dallas County, a useful indicator might be two consecutive days with high temperatures above 100°F and low temperatures above 80°F.

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